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Objectives

A major finding of the European Antimicrobial Resistance Surveillance Network (EARS-Net) Report 2009 is the high prevalence of resistance in invasive *K. pneumoniae* isolates from hospitalised patients to third-generation cephalosporins (3GC), fluoroquinolones (FQ) and aminoglycosides (AG) and the high level of combined resistance to these classes in most European countries. Data from the German Antimicrobial Resistance Surveillance (ARS) System are used to extend the study of resistance to isolates from urine and respiratory samples as well as to outpatients.

Materials & Methods

The dataset is taken from the German Antimicrobial Resistance Surveillance (ARS) System. In contrast to the EARS-net surveillance limited to invasive isolates from inpatients, ARS collects resistance data for all species originating from all kinds of specimens taken in hospitals as well as in ambulatory care.

Analysis is based on non-duplicate isolates of *K. pneumoniae* collected in 2009 by eight laboratories covering 160 hospitals and 865 practices. Species identification and antimicrobial susceptibility testing is performed by VITEK 2, results are evaluated according to CLSI guidelines.

Isolates are classified as resistant to an antibiotic class if they show resistance to one of its agents:

- third-generation cephalosporins: ceftazidime or cefotaxime or ceftriaxone
- fluoroquinolones: ciprofloxacin or levofloxacin
- aminoglycosides: gentamicin or tobramycin or amikacin.

The distinct class resistances are combined to resistance patterns.

References

ARS-Website: <https://ars.rki.de>

Antimicrobial resistance surveillance in Europe 2009. Annual report of the European Antimicrobial Resistance Surveillance Network (EARS-Net).

Results

The sample is composed of 5,548 non-duplicate *K. pneumoniae* isolates from inpatients (blood: 299; respiratory samples: 1,118; urine: 4,131) and 2,666 isolates from outpatients (respiratory samples: 173; urine: 2,493).

Results are displayed in table 1 and visualised in figure 1 below. Proportions of resistance are highest against fluoroquinolones in all subsets ranging from 21.1% in blood cultures from inpatients to 4.6% in respiratory samples from outpatients followed by third-generation cephalosporins (16.4% to 3.5%) and aminoglycosides (13.4% to 2.3%).

Regarding resistance against the three antibiotic classes simultaneously reveals that triple resistance is the most frequent pattern in all inpatient subsets reaching 10.0% in blood cultures, 9.3% in respiratory samples and 6.8% in urines. In outpatient samples, single resistance against fluoroquinolones is the most frequent pattern followed by triple resistance in second place accounting for 3.0% in urine samples and 1.2% in respiratory samples.

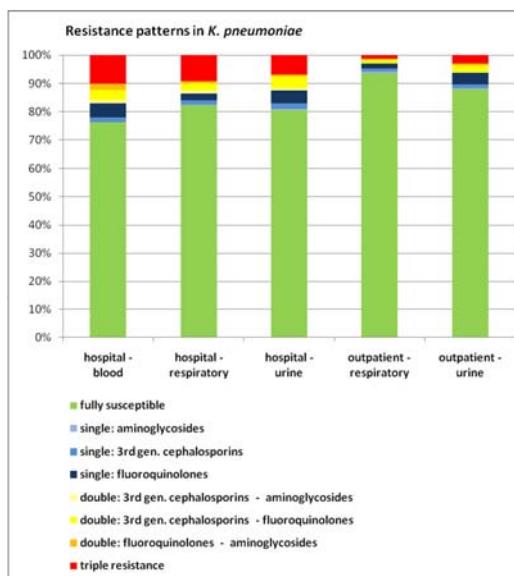


Figure 1: Resistance patterns in *Klebsiella pneumoniae*

Results

	Hospitalised patients		Outpatients		
	Blood	Respiratory	Urine	Respiratory	Urine
Resistance to antibiotic class					
Fluorochinolones (FQ)	21,1	15,0	16,1	4,6	9,9
Third-gen. cephalosporines (3GC)	16,4	14,5	13,8	3,5	7,1
Aminoglycosides (AG)	13,4	10,9	8,9	2,3	4,3
Resistance patterns					
Fully susceptible	76,3	82,4	80,5	93,6	88,0
Single resistance	6,7	4,1	7,0	3,5	5,7
FQ	5,0	2,5	4,5	1,7	4,0
3GC	1,7	1,5	2,1	1,2	1,4
AG	0,0	0,1	0,4	0,6	0,3
Double resistance	7,0	4,2	5,6	1,7	3,2
FQ + 3GC	3,7	2,7	4,0	1,2	2,3
FQ + AG	2,3	0,5	0,8	0,6	0,6
AG + 3GC	1,0	1,0	0,9	0,0	0,4
Triple resistance FQ + AG + 3GC	10,0	9,3	6,8	1,2	3,0

Table 1: Resistance in *Klebsiella pneumoniae* isolates from hospitalised and outpatients in Germany 2009: proportions of resistance against fluoroquinolones, third-generation cephalosporines and aminoglycosides and frequencies of combined resistance to these antibiotic classes stratified by origin: blood culture, respiratory and urine samples

Conclusion

Surveillance limited to invasive isolates from hospitalised patients like EARS-Net captures the sector with highest levels of antimicrobial resistance in *K. pneumoniae*; the extended approach of ARS reveals an emerging problem in outpatient care that physicians should be aware of, even if resistance proportions might be overestimated as samples are more likely to be taken from pre-treated patients.

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